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A STUDY OF EFFICACY OF OPEN REDUCTION, BONE GRAFTING WITH OR WITHOUT KIRSCHNER WIRE FIXATION FOR TREATMENT OF SCAPHOID NONUNION THROUGH A VOLAR APPROACH

Orthopaedics

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ABSTRACT

Background: Non-union Scaphoid cases are very frequently seen in the young usually especially in the 2nd and 3rd decade of life especially in males. The morbidity is significant as the age group and gender is considered to be the breadwinners of the family. This study was undertaken to find out the functional outcome of non-union scaphoid treated with and also the efficacy of volar inlay bone grafting.
Methods: This is a both retrospective and prospective study of 18 patients who was operated for scaphoid non-union.
Results: Volar inlay bone grafting with a wedge or trapezoidal iliac graft and Kirshner wire fixation gives good union results
Conclusion: This Protocol of management of Nonunion Scaphoid is effective as it gives a good functional result.

KEYWORDS

Retrospective and Prospective Study, Bone graft, Scaphoid Non-union, Volar Approach.

INTRODUCTION:

Non-union Scaphoid occurs more frequently in the young usually between 15-30 years with male predominance. The persisting pain and weakness of grip can cause considerable morbidity to the patient. Acute fractures of the scaphoid are frequently mistaken for wrist sprain initially and treated inadequately. Scaphoid by its inherent nature has a low healing potential, compounded by instability of the fragments due to intercarpal attachments, inadequate treatment and patient non-compliance leads to nonunion in a significant percentage of cases.

Treatment of non-union scaphoid is also challenging because of the small size of the bone, low healing potential [1] and instability. Different methods ranging from bone grafting with or without osteosynthesis with K wires, A.O screws, Herbert screws, Staples and for complicated non unions, vascularized bone grafting, salvage procedures for failed non unions have been described with varying results. Most of these procedures have a very high learning curve and results are not consistent with various surgeons and some are also too expensive to perform.

This study was undertaken with a view to find out the functional outcome of non-union scaphoid treated at our institution and also the efficacy of volar inlay bone grafting.

AIMS AND OBJECTIVES:

To study the efficacy of Open reduction, Bone grafting with or without Kirschner Wire fixation for treatment of Scaphoid Nonunion through a Volar approach.

MATERIALS AND METHODS:

This is a both retrospective and prospective study of 18 patients who was operated for scaphoid non-union.

INCLUSION CRITERIA:

1. Radiographic evidence of Scaphoid Nonunion.
2. Cases admitted to the hospital between January 2000 to December 2003, a total of 4 years.

1. Previous surgeries on nonunion scaphoid.
2. Associated other carpal bone fractures.

The patients came with complaints of pain in the wrist associated with stiffness of the wrist with difficulty to lift weight or grip objects firmly following a history of fall on an outstretched hand or fall from a height or wrist being dorsiflexed forcefully .The treatment taken for the same is noted.

A thorough clinical examination noting the exact site of tenderness, degree of restriction of wrist movement, subjectively assessing grip strength, wrist instability were noted comparing the normal wrist.

If the patient has not got the previous x-rays, then wrist PA, Lateral and oblique view is taken. The site of fracture, fracture characteristics, like displacement, sclerosis, cysts were noted. Avascular necrosis of the fragments, DISI deformity were looked for. Only Radiolunate and Capitolunate angles were measured. Scapho-lunate and intrascaphoid angles were not measured because of the overlapping of carpal bones. Mack et al's grading of wrist degeneration was used to note the degenerative status of the wrist. The scaphoid non-union was classified according to Herbert's classification.

Under tourniquet, a volar approach as described was used to expose the fracture site. The fracture ends were curetted of all the fibrous tissue and looked for punctate bleeding, a sign of vascularity. Using skin hooks, the deformity were corrected, the gap assessed and a corticocancellous wedge or trapezoidal graft is taken from the ipsilateral iliac crest and plugged into the defect. Cancellous chips added if still there is any space.

The scaphoid was stabilized with a kirschner wire drilled disto-proximally, confirmed fluroscopically. The wound is closed in layers with K wire protruding through the skin and a scaphoid cast is applied.

The patient is discharged after 3 days. At 2 weeks, a small window is made, sutures removed and cast completed.

3 months depending on the progress. Each time, using the Modified Scaphoid outcome Scoring System developed by Robbins et al, the functional outcome is noted.

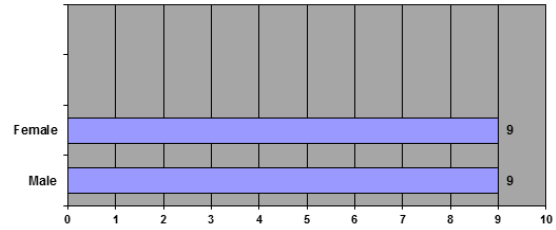
Modified Scaphoid Outcome Scoring System (Robbin's et al 1995)

Pain	
No Pain	4
Occasional ache	3
Ache after work or sports	2
Pain after work or sports	1
Daily pain not associated with activity	0
Motion and strength of wrist	
Able to return to pre-injury work	2
Unable to return to pre injury work	1
Always limits work or activity	0
Occupation	
Never limits work or activities	2
Occasionally limits work or activities	1
Always limits work or activities	0
Overall satisfaction with result of operation	
Improved quality of life	2
Did not change quality of life	1
Worse quality of life	0

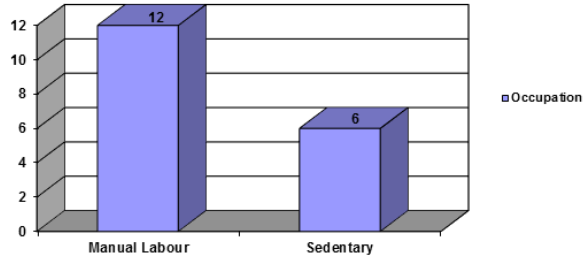
10: Excellent 8-9: Good 6-7: Fair 5 or less: Poor

RESULTS:

Total Number of Cases	18
Male to Female Ratio	18: 00
Mean age	26 years (17-41 years)
Dominant Hand	All were Right hand dominant



Graph 1: Affected wrist M:F 9:9



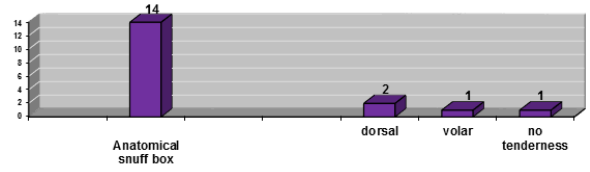
Graph 2: Occupation

Mean duration since injury: 16 months (6 months to 120 months)

Only 3 of the 18 patients had a cast for 4-8 weeks.

Table 1: Clinical Presentation

Pain	18 patients
Stiffness in the wrist	11
Weakness in grip	12

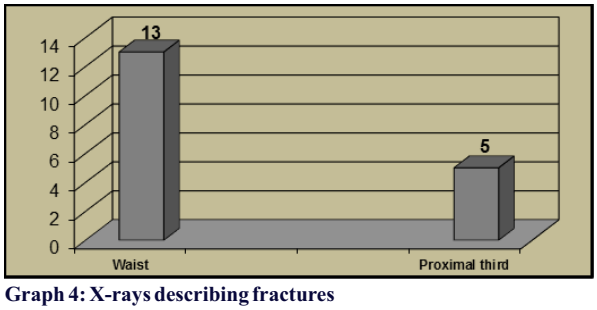


Graph 3: Tenderness location

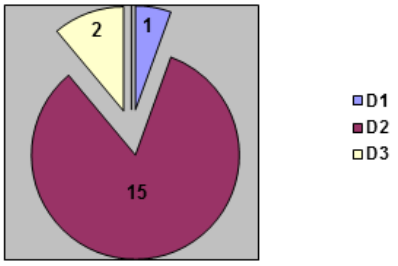
Grip strength was decreased in 12 of the 18 patients.

X-Rays:

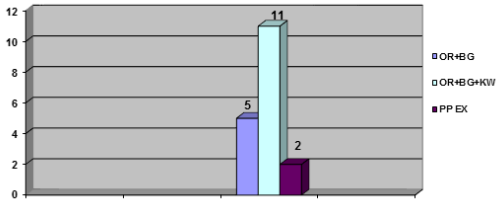
There were 13 waist fractures and 5 proximal third fractures.
Displacement was present in all but 1 patient.
Only 1 patient was Stage II (Mack's Criteria), the rest were Grade I.



Graph 4: X-rays describing fractures



Graph 5: According to Herbert's classification, 15 were D2, 2 were D3 and only 1 was D1

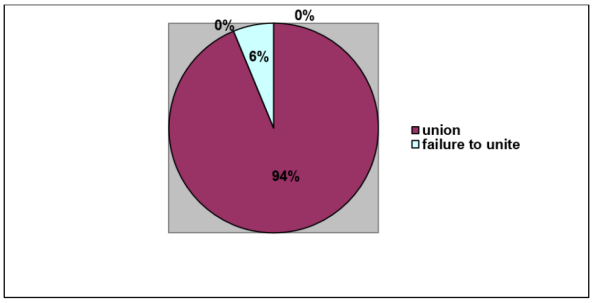


Graph 6: Surgeries

OR + BG = Open Reduction and Bone grafting
OR+BG+KW=Open Reduction, Bone Grafting and K-wire fixation
PP EX= Proximal Pole excision

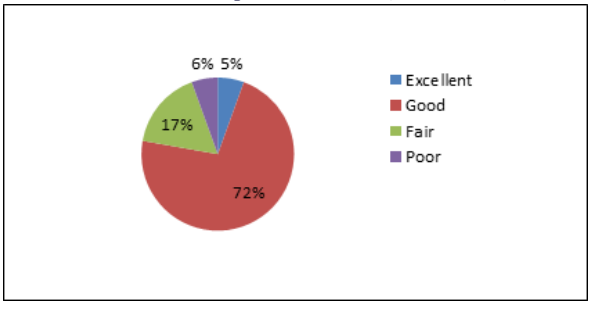
Mean Duration of Cast Immobilisation in cast: 3.3 months (3-5 months)

Only 1 case was a failure, in rest of the cases (15) the fracture united (94%)

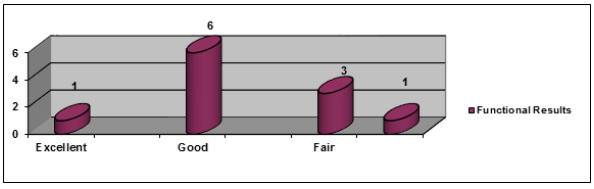


Graph 7: Non-Union

Mean Duration of follow up 15 months (4- 48 months)



Graph 8: Functional Outcome: (Whole series)



Graph 9: Mean Functional Score

Rate of Union in Open Reduction, Volar bone grafting alone
100 %

DISCUSSION:

Non-union scaphoid alters the wrist kinematics and destabilizes the wrist. It can cause considerable morbidity to the patient in the form of pain, limitations is movement and grip. It can, due to various intrinsic and extrinsic causes previously mentioned can test the patience of the patient and the doctor. Various procedures have been described with various results. Our study of 18 cases is comparable to those of Russe in 1960 (22 cases), Dooley in 1968 (23 cases), Robin R Richards in 1991 (10 cases). We have only taken wrist P.A lateral in neutral flexion and scaphoid view since it gave adequate information about the fracture. Too many views were not taken as it would cost more to the patient and no extra information is obtained so as to change the management. We operated on all cases because if left alone would lead to progressive degenerative arthritis of the wrist with carpal collapse

with in a period of 5-10 years and this is not acceptable because of the morbidity it can cause to the patient at a young age. (Gregory Mack [2] and Ruby et al [3])

We chose to go for the volar approach because it

1. Preserves the dorsal blood supply.
2. The fracture site and the flexion deformity is easily exposed and corrected.

The fracture ends were curetted till evidence of punctate bleeding, the deformity corrected and the result gap was measured to harvest the graft.

All cases were grafted because to hasten the healing of the fracture. Iliac crest was the chosen site as:
1. It is easy to harvest.
2. It has the best osteogenic, osteoconductive and osteoinductive potential.
3. Any amount of graft can be harvested and shaped to the required size without causing much morbidity.

A wedge or trapezoidal cortico-cancellous graft is used as it corrects the flexion deformity at the fracture site.(Russe grafting creates a cortical defect volarly).

We used Kirschner wires only if the fracture graft construct is unstable. Only K-wires were used as this was easy to perform, time saving procedure and gives equally good results.

After wound closure, a below elbow thumb spica (scaphoid cast) was applied as we felt it necessary to immobilize the scaphotrapezial joint for better fracture stability. We found that below elbow cast was sufficient as the movements due to pronation and supination at the fracture site was not significant compared to the elbow stiffness that occurs during above elbow immobilization.

At the end of 8 weeks, the patient was reviewed, the cast removed, x-ray taken with k wire in situ. The wire was removed after assessing the fracture union. Another scaphoid cast was given for 4-6 weeks depending on the fracture union. Cast was applied till fracture union. William.P. Cooney et al [4] gave a long arm cast post operatively for 6 weeks followed by a thumb spica til union which was a median of 4.5month with a range of 3-11 months (Our series : 3-5 months).

The mean duration for union is 3.3 months which is comparable to that of Karen Daly [5] (4months for volar wedge grafting and Herbert screw fixation), Robin R Richards in 1991 (3-6 months).

We have found fracture union in 91% of the cases (only 1 out of 15 did not unite). We have also found union rate of 94 % in cases with open reduction, bone grafting and k-wire fixation. All the 5 cases with open reduction and bone grafting alone have united with in 3-5 months. The results are comparable with that of Cooney et al (1980)[4] – 86 %. Karen Daly et al (1988) – 97% performed cortico cancellous bone grafting. Rajagopalan et al [6] reported 86 % union is his series of scaphoid non-union treated with Herbert screw fixation with volar bone grafting.

94 % of our waist fractures united and 60 % of our proximal third fractures united. This is comparable to William P. Cooney's series 6 where 80 % of M/3 non-unions united and 64 % of proximal third fractures united)

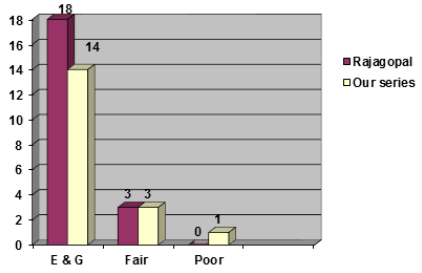
Our results are also comparable with that of Karen Daly et al where he achieved 95 % union in cases treated with volar wedge grafting and Herbert screw fixation with a median time of 4 months for union.

Herbert et al [7,8] reported 82 % union with Bone grafting and Herbert screw fixation for D1 andD2 body fractures where as ours is 94 %.

We used Modified Scaphoid outcome by Robin et al as we found that compared to Mayo Wrist scoring system [9] and the Herbert scoring system [10], this was more specific though all are subjective assessment systems

Table 5: Comparison with other study

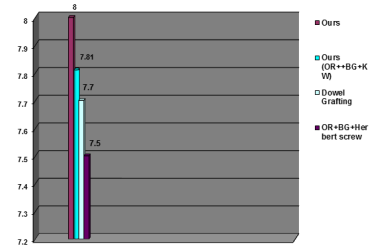
	Series	Total Cases	Excellent & Good	Fair	Poor
1	Rajagopalan et al	21	18	3	0
2	Our series	18	14	3	1



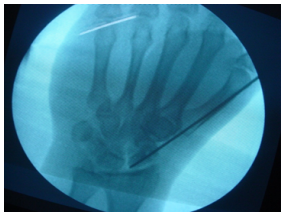
Graph 10: Comparison

Of the 18 cases, 1 had poor result probably because of combination of factors like loss of reduction due to unstable fixation, patient noncompliance and avascular necrosis of the proximal fragment.

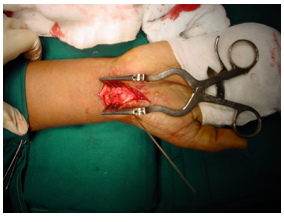
The mean function outcome score for our series is 8.0 (total series) and 7.81 for cases who have undergone only open reduction, bone grafting and k-wire fixation which is comparable with 7.5 for cases treated with volar bone grafting with Herbert screw fixation and 7.7 for cases treated with precision bone grafting (dowel grafting) in a series 2000.



Graph 11: Comparison with other study



Annexure



Annexure

CONCLUSION:

1. The Protocol of management of Nonunion Scaphoid followed at our institution is effective as it gives a good functional result.
2. Volar inlay bone grafting with a wedge or trapezoidal iliac graft and Kirshner wire fixation gives good union results.

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